

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

December 20, 1866.—Dr. William Allen Miller, Treasurer and Vice-President, in the Chair.

“On the Formation of ‘Cells’ in Animal Bodies.” By E. Montgomery, M.D.

I. *Observations.*

So called organic “cells,” chiefly those of various cancerous tumours, were seen, on the addition of water, to expand to several times their original size, and at last to vanish altogether into the surrounding medium.

The “nucleus” did not always participate in this change, but at times remained unaltered, whilst the outer constituents of the “cell” were undergoing this process of expansion.

This curious phenomenon of extreme dilatation is intelligible only on the supposition that the spherical bodies in question are in reality globules of a uniformly viscid material, which by imbibition swells out till at last its viscosity is overcome by the increasing liquefaction.

In embryonic tissues and in various tumours, single “nuclei” were seen, each surrounded by a shred of granular matter. On the addition of water there would bulge from one of the margins of the granular mass a segment of a clear globule, which continued growing until it had become a full sphere, which ultimately detached itself, and was carried away by the currents. At other times no such separate globule would be emitted, but the entire granular shred would itself gradually assume the spherical shape, ultimately encompassing the “nucleus,” and constituting with the same the most perfect typical “cell.”

Not only single “nuclei” were found, each surrounded by a shred, but also clusters of two, four, or more were seen similarly enclosed by a proportionately large granular mass. Under these circumstances it sometimes occurred that, on the addition of water, the whole granular mass of such a cluster became transformed into a large sphere containing two, four or more “nuclei.” The resulting body was to all appearance identical with shapes well known under the name of “mother cells.” In all these cases the granular shred must have partly consisted of a viscid material, which, on imbibition, naturally assumed the spherical shape.

Primary globules were surrounded by a secondary globule, and thus the typical “cell” was completed under the observer’s eye.

In some instances the globules resulting from the transformation of the granular mass were at first bright and transparent, the granules having completely disappeared. They, however, gradually re-formed, showing at first molecular motion, then crowding more and more, till at last the whole mass seemed to undergo coagulation.

Alternate liquefaction and coagulation of the same material was found to play an important part in the development of “cells.”

Masses of certain viscid materials do not, on imbibition, expand

uniformly throughout their entire bulk, but globules of a definite size are emitted, as many as the mass will yield.

The crystalline lens of many young animals affords, when treated with water, a beautiful illustration of this fact. Its homogeneous material is transformed, under the influence of imbibition, into a vast number of globules of nearly equal size.

Hyaline embryonic tissues display, under similar conditions, the same phenomenon.

Certain inferences lead one to suspect that this size-limiting property is due to the crystallizing propensity of some ingredient of these viscid substances.

Blood-corpuscles (human blood-corpuscles at least) are evidently tiny lumps of a uniformly viscid material.

When broken up into fragments, each fragment assumes the spherical shape.

On slow imbibition, they often emit a clear sphere, or a segment of one.

In various specimens of foetal blood, each blood-corpuscle was seen to emit as many as two or even three equal-sized globules, the original corpuscle being at last no longer distinguishable from its descendants. This is sufficient proof of the uniformly viscous nature of the blood-corpuscles.

In many cancers the most recently formed part consists of mere fibres. These after a time become "nucleated." The "nuclei" are at first very elongated, this being due to the lateral pressure of the still fibrous texture. But as the mass gradually softens, the ovals expand more and more into spheres, forming the primary globules, round which, as has already been shown, a secondary globule is often seen to shape itself.

Chemical differentiation transforms first one portion of the fibrous mass into viscid material. This at once strives, by imbibition, to assume the globular shape. The remaining portion may or may not ultimately undergo similar transformation.

Inflamed serous membranes become often densely "nucleated." In the deeper layers, the "nuclei" are very elongated. At the surface they are perfectly globular, and are detached as minute opaque balls. These balls are the granulation- or the pus-corpuscles. On imbibition, one portion of their soft material swells out, encompassing the rest, which, when forming a single uniform globule, goes under the name of granulation-corpuscle—when, on the other hand, broken up into several granules, constitutes the famous pus-"cell." This is an example of a second mode of "cell"-formation. Here the secondary globule is shaped from a portion of the primary mass.

In some instances these "nuclei" or balls will, when still enclosed within the surrounding texture, undergo the above-mentioned change on imbibition; and thus whole rows of granulation- or pus-corpuscles are seen to form.

This second mode of "cell"-formation is still more strikingly manifested in epithelial textures. In the mucous membrane of the

nose, for instance, the faint oval "nuclei" of the large scales become during disintegration more and more distinct and globular. The surrounding material of the scale gradually liquefies, and the minute balls, thus liberated, expand by imbibition into mucus- or pus-corpuscles. It often succeeds in causing them to form in all perfection whilst they are still contained within the scale.

In abscesses of the skin the pus-corpuscles are formed in exactly the same manner. They can often be watched, fully shaped, still enclosed within the scale. Here, it would seem, are "cells" not the result of life, but rather of death.

The multiple "nuclei" of pus-corpuscles are not the result of over-fecundity, but are simply due to the disintegration of the non-imbibing portion of those oval or spherical sharply defined bodies which are themselves so well known under the name of "nuclei."

The disintegration of this non-imbibing portion can be traced through all possible stages, down to the cluster of most irregularly shaped granules (which, notwithstanding, have been looked upon as the result of fissiparous division), and has been made to represent the crowning feature of the cell theory.

The same minute balls found swimming in the serum of a blister were seen, when treated with water, to disclose single bright sharply defined "nuclei;" when treated with acetic acid, to reveal the most typical multiple nuclei of pus-cells.

II. *Experimental Verification.*

In all the above-cited observations the existence of a viscid imbibing material was proved with almost conclusive evidence,—a viscid material which is capable of forming globules of a definite size, and which in the living organism actually forms such globules—shapes, the nature of which has been hitherto mistaken.

After a long search, the substance known under the name of myeline was found to be the desired material.

When to myeline in its dry amorphous state water is added, slender tubes are seen to shoot forth from all free margins. These are sometimes wonderfully like nerve-tubes in appearance. They are most flexible and plastic. From this curious tendency of shooting forth in a rectilinear direction, it was inferred that a crystallizing force must be at work.

To counteract this tendency, and to oblige the substance to crystallize into globules, it was intimately mixed with white of egg. The result was most perfect. Instead of tubes, splendid clear globules, layer after layer, were formed, resembling closely those of the crystalline lens formed under similar conditions.

Here was actually found a viscid substance which, on imbibition, formed globules of a definite size.

The remaining task was comparatively an easy one. By mixing the myeline with blood-serum, globules were obtained showing the most lively molecular motion.

When the serum somewhat preponderated, the whole of the globules

seemed, after a while, to undergo coagulation, and appeared often as beautifully and finely granulated as any real "cell."

When this mixture of myeline and serum was spread very thinly over the glass slide, there often started into existence, on the addition of water, small primary globules, round each of which an irregular mass of granular material became gradually detached from the glass slide. It at last shaped itself into a secondary globule, enclosing the primary one, and constituting with it, down to the minutest details, the most perfect typical "cell." In many instances the nucleolus did not fail; and the narrow white margin, so often mistaken for a cell-wall, was always present. Beautiful "mother cells" were formed in the same manner.

The next endeavour was to form "cells" according to the second mode.

If the amorphous myeline be very thinly spread on the glass slide, instead of tubes there will form bodies looking like rings. They are actually double globules, the inner globule being more transparent than the outer. They correspond to the inner and outer substance of the above-mentioned tubes. When these are left to dry, and then again acted upon with water, one portion will swell out into a clear globule, enclosing the rest as "nucleus." These "nuclei" are either large and single, like those of granulation-corpuscles, or they are multiple, exactly like those of pus-cells. Whole layers of perfect pus-corpuscles are thus formed. But, of course, more complicated shapes occur as well—among these, for instance, many such pus-cell-like bodies enclosed within one large sphere.

If, instead of water, serum be added to the thinly spread myeline, biconcave disks will form, only generally much larger than blood-corpuscles.

"Cells" being thus merely the physical result of chemical changes, they can no longer afford a last retreat to those specific forces called vital. Physiology must aim at being something more than the study of the functions of a variety of ultimate organic units; and pathology will gain new hope in considering that it is not really condemned to be the interpreter of the many abnormalities to which the mysterious life of myriads of microscopical individuals seemed to be liable.

MISCELLANEOUS.

THE LATE MR. JOSHUA ALDER.

WE regret to announce the death, on the 21st of January, of Mr. Joshua Alder, of Newcastle-on-Tyne, at a somewhat advanced age. He was a true naturalist—working diligently and carefully himself in the field of marine zoology, and encouraging his fellow-labourers (by all of whom he was much beloved), without any petty feeling of jealousy or affectation of superiority. Mr. Alder was frequently a contributor to this periodical. His departure from the ranks of British naturalists was not long preceded by that of a still